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THE AMERICAN MEDICAL ASSOCIATION: ITS ORIGIN, PROGRESS AND PURPOSE.[1]

BOTH established usage and the by-laws of this association require the presiding officer to deliver annually an address touching such matters as he may deem of importance. In the early years of the association the president's address was devoted to an epitome of the progress of medical science in its various departments during the preceding year. Since distinguished orators are now selected annually to perform this important service, the president's address may be more appropriately directed to subjects relating to the general welfare of the profession and to the purposes for which this great organization was established.

The annual session of the American Medical Association is always an occasion of special moment and universal interest to the medical profession of America. That several thousand physicians from all sections of our broad country assemble annually for the advancement of medical science and the elevation of our profession is a splendid testimonial to the earnestness of professional achievement and aspiration. The occasion can not but command the respect of all who are concerned in the progress of science and the betterment of the human race. The spirit which pervades such an assemblage is the desire for improvement, for the increase of scientific re-

[1] President's address, at the fifty-sixth annual session of the American Medical Association at Portland, Oregon, July 11–14, 1905. From *The Journal of the American Medical Association.*

sources, and for the diffusion of medical knowledge. Closely related to these ennobling purposes is that social instinct of our profession, which would elevate and be elevated by interchange of views resulting from common experiences, and by mingling together in pleasant friendly intercourse. Happily our present meeting is held under ideal conditions for the exercise of all the functions of such an organization. Perfect harmony prevails. The differences which at times have divided us have all been satisfactorily adjusted; and we are today as one man in our united effort to advance the science of medicine, to enlarge the scope of its beneficence and to promote the welfare of our profession.

Since our meeting at Atlantic City one year ago, many of our members have ceased their labors and passed to the great beyond. The list is a long one. Among the number is that of Nathan Smith Davis. He was one of the founders of this association, an ex-president; a member of the board of trustees, the first editor of the *Journal,* and for years a power for good in its affairs. He lived beyond the time allotted by the psalmist, and all his years were filled with labor and with honor. I will not undertake at this time to estimate adequately his great services, or appropriately to pay tribute to his memory. This will be done later in the session by one better prepared than I to eulogize our departed leader.

At our last session, Dr. B. C. Pennington, of Atlantic City, was chairman of the committee of arrangements. He was honored with the fourth vice-presidency in recognition of his ability, his high professional standing, and his devoted services to this association. His name, too, is now found among the year's honored dead. A cultured gentleman, a learned and accomplished physician, his memory will ever remain as an inspiration for high ideals and noble endeavor.

EARLY YEARS.

When the American Medical Association was organized in 1846 it is doubtful if there were more than 25,000 physicians in the entire United States of America. It was organized as a representative body, composed of delegates from affiliated societies, colleges and hospitals throughout the states. It was a body of delegates from all state, district, county and other medical societies which adopted the code of ethics of the national association. The apportionment of delegates was on a basis of one for every ten members of the societies represented. For a number of years the delegate body thus constituted was not too large for the discussion of important subjects and the ready transaction of business.

With the rapid increase in population, the admission of new states to the union, and the settlement of new territories, came a vast increase of physicians, with a corresponding multiplication of state and county societies. Without change in the apportionment of delegates, the national association developed into a body too large and unwieldy for the transaction of business. Indeed, during the latter years under the original system of organization, practically every member in attendance on the annual sessions was a delegate. While the work of the sections was carried on with increasing excellence, the important functions relating to legislative and other matters, belonging to a great national organization of the medical profession, were neglected. The general sessions brought together hundreds of delegates, forming a convention so large that thorough discussion of important questions and judicious action on the same became practically impossible. Moreover, the delegates attending the annual sessions

constituted a body annually changing in personnel; and the sources of attendance changed with the sections of the country in which the meetings were held. In consequence there could be neither that equal representation of all sections which must obtain in a national body, nor continuation of work from year to year along definite lines.

THE SECTIONS.

During these early years it was the steady improvement in the work of the sections which drew the best element of the profession to the annual sessions. Many leaders of the profession in the various states attended the sections in which they were interested, and took no part in the proceedings of the general meetings. The sections have now reached such a high degree of efficiency that they have attained the standard so much desired, and rank as leading special national societies in the several departments of medical science which they represent.

As chairman of the committee on sections and section work, I have carefully studied the workings of the sections. As a result of this experience, I would repeat the recommendation of my distinguished predecessor in this chair, that the secretary of each section should be elected for a term of years. No national society can maintain its efficiency which changes its secretary annually. And again, I would suggest that the officers of the several sections meet together in conference as soon as practicable after the adjournment of the session at which they are elected, in order that definite plans may be formulated for the scientific work of the next annual session. The conference of section officers in New York last November contributed much toward the development of the admirable scientific program now before you for the present session.

It should be the aim and purpose of every member of this association to aid the officers of the sections in elevating continually the standard of scientific work. Every American physician may have pride in the work done year after year in the sections of this association.

THE JOURNAL.

It would be a difficult task were we to undertake a definite estimate of the influence of the *Journal* in the great work which this association has accomplished during the past two decades. When it was decided to discontinue the annual volume of transactions, and to establish a weekly journal, the change was viewed with apprehension by many. The influence of this publication, the property of the association, in stimulating research, diffusing knowledge, elevating professional thought and conduct, and building up this great organization can not be computed. This part of my discourse is so replete with suggestion, that I fear the time and space at my command will not permit such consideration as should be devoted to it.

The volumes of the *Journal* mark the steady and continued growth of the association, and likewise bear testimony to the fact that the *Journal* itself has been a potent factor in that growth. Under the judicious direction of the board of trustees the *Journal* has steadily advanced as a scientific publication. By the untiring daily services of the present able editor, it has leaped into the very front rank of scientific publications, and in all that a great weekly medical journal should be it has no superior in the world. The power exerted by such a publication as a medium of communication among the members of the association is inestimable, to say nothing of the other more important functions performed by a great weekly journal. It has been

the most potent instrument in building up this association to its present proud position as the largest medical organization in the world. No other American medical periodical has a circulation so distinctly national, and no other journal can sustain the same relation to the great body of the medical profession. It is a great engine whose power is constantly increasing, constantly extending. With such increased power comes increased responsibility, much of which rests with the house of delegates in the selection of proper men to fill the responsible places of the trustees. No other office should be regarded higher in honor than that of the trustees, as no other affords greater scope for unselfish labor and efficient service to the association. Under the conditions of our organization more power is invested in this board than the combined power of all other officers.

THE NEW ERA.

At the annual session of 1900 a committee on reorganization was appointed, and one year later, at St. Paul, the report of the committee was submitted and adopted. It included a new constitution, which altered the basis of apportionment for delegates, so as to reduce the delegate body to 150, and definitely established a close relationship between the national organization and the state, district and county societies. For the first time a practical scheme of complete organization of the medical profession of the United States was provided. This is the fourth annual session held under the new plan of organization.

Previous to the reorganization, the valuable scientific work of the sections constituted almost the sum total of the effective work accomplished by the association. Matters appertaining to medical education, to the public health, to national legislation and to the welfare of the profession received no deliberate consideration; and in consequence no decisive action was carried out. This condition existed for the reasons already mentioned. In a word, the very objects and aims for which the association was organized were thwarted by the growth of the association into an unwieldy delegate body. Under the reorganization, the house of delegates, in which the membership of the state societies is proportionately represented, now gives deliberate consideration to those important matters, already indicated, which under the former organization were neglected.

The influence of the revised plan of organization was immediately apparent in the increased attendance at the annual sessions, and the stimulus felt in every purpose of the association. And each year this influence has grown, until some idea can now be formed of the great possibilities to come from organization on a definite and practical plan. The good results which accrue to the profession as a whole, and to every member as an individual, are so positive that no subject can deserve more careful consideration by this body than that of medical organization. Indeed, it is the fundamental question before us, and on its decision depend the results of all our other efforts in all directions.

In order that we may thoroughly appreciate the origin and purpose of the association, and thereby be better prepared to meet its present and future requirements, I have very imperfectly outlined the history of its earlier years. During the more than half century of its existence it has always brought to its councils the ablest and best men in the profession of America. Among its leaders from the beginning are found the most eminent physicians and surgeons of the day. In the list of its active members are the names of Samuel D. Gross, Paul F. Eve, Austin Flint, Marion Sims,

N. S. Davis, Alfred Stillé, Lewis A. Sayre and many others which adorn the annals of American medicine. It has from the beginning been a great power with the profession of America. Its greatest influence, as I have already indicated, was in the growth and diffusion of scientific knowledge through the splendid work of the sections. In elevating medical education, in promoting legislation and advancing the powers of public health organizations, its influence was most felt in the development of a helpful public professional opinion. The extension of the influence and advantages of organization to the masses of the profession was gradually lost sight of in the annual meetings, and the work relating to matters of public policy was spasmodically considered and imperfectly executed. Whatever was accomplished along these lines worthy of mention was the work of committees. The necessity of reorganization was appreciated by the leading members of the association long before it was accomplished. In 1888, Dr. N. S. Davis, as chairman of a committee appointed for the purpose, reported a scheme of reorganization very similar to that adopted in 1901 at St. Paul.

ORGANIZATION.

The object of this association shall be to federate into one compact organization the medical profession of the United States, for the purpose of fostering the growth and diffusion of medical knowledge, of promoting friendly intercourse among American physicians, of safeguarding the material interests of the medical profession, of elevating the standard of medical education, of securing the enactment and enforcement of medical laws, of enlightening and directing public opinion in regard to the broad problems of state medicine, and of representing to the world the practical accomplishments of scientific medicine. (Article II., constitution of the American Medical Association.)

If every physician worked alone, relied on his own unaided observation for his knowledge, never looking outside his own scope of view, ignorance would prevail and there would be no progress in medical science. Medicine is not an exact science, and until perfected by extorting from nature all her secrets, it must from the nature of things continue to be a progressive science. Never before in the history of medicine has such marked progress in all its departments been made as during the present age. Theories have been supplanted by facts; laboratory research and clinical investigation have taken the place of tradition and authoritative opinion. To rely on the accomplishments of the college period is to be left behind in hopeless incompetency. The advance of medical knowledge is to be observed first in our medical societies, and afterward in our scientific medical journals. In the medical societies innovations are subjected to criticism and discussion by those competent to judge the merits of scientific contributions. Moreover, there is a stimulus to study and investigation from association with workers in the same field; and one obtains a broader view of every subject so considered. The physician, more than any other professional man, is isolated by the conditions of his life, and to no profession is the educating influence of society work so essential and invaluable. This same condition of isolation is at the foundation, for the most part, of the jealousies and petty bickerings so prevalent in our profession. These troubles are, as a rule, the result of misunderstandings, and are both prevented and corrected by coming together in a society composed of physicians. The lonely worker in any calling is prone to become narrow, suspicious and morbid. Our medical societies are the great post-graduate schools of the profession, where knowledge is increased and individual character developed.

But the promotion of scientific investiga-

tion, and the diffusion of medical knowledge are not the only objects of organization. Our profession has a most essential and important duty in relation to the public health. Through no other agency can municipal, state and national health authorities formulate and secure recognition of laws to prevent and control disease. Another duty no less essential is so to regulate and to control medical education that the ignorant and unworthy shall not be admitted to the privileges of the profession, thereby preserving the time-honored standard of professional honor and scientific capability. In this age of organization, without it the profession is powerless to secure the enactment of humane sanitary laws, by which alone the people can be protected from preventable diseases. The welfare of the profession collectively and individually can only be subserved by organization. Without such organization, our profession, as a body politic, will be without unanimity of sentiment or action in relation to the important scientific, ethical and social questions which confront us; and consequently without influence politically, socially or otherwise.

In the declaration of the constitution adopted at St. Paul, which I have just quoted, the American Medical Association has undertaken to place within reach of every reputable medical practitioner in the United States these incalculable advantages of medical organization.

The committee on reorganization appointed in 1900 has treated this subject in a masterly manner. After a careful study of the condition of the profession throughout the states with relation to organization, reports have been made to the association showing the needs of the profession and the extent of the work required. A uniform plan of organization for state and county societies, making the county society the unit of organization, and federating all state societies in the national association in harmonious cooperation, has been prepared by the committee. The able chairman of this committee has with remarkable tact, patience, and good judgment given his personal supervision to this great work in almost every state and territory. In his latest report it is announced that all the states and territories, except three, and including Hawaii and Porto Rico, are now organized on a practically uniform plan, with universal local societies, and coincident membership in them and the state associations as the cardinal feature. To illustrate the magnitude of this work, I mention that, under the stimulus of reorganization after the plan of the committee, the Michigan State Medical Association increased in membership in one year from 452 to about 2,100. Texas increased the membership in the same time from 382 to 2,510, while several states quadrupled their membership. While these results are phenomenal, and elicit our admiration, it will be realized how much remains to be done when it is considered that few of the states have over 50 per cent. of the eligible members of the profession enrolled as members of the society. Indeed, the work is yet almost in its infancy. What has been accomplished is an assurance for the future; and considering the brief time since reorganization began, is a high tribute to the enterprise of the national association and the work of its able and efficient committee. The possibilities of this work are stupendous, and as it proceeds the association can confidently undertake the great reforms of such incalculable moment to the profession and the public. In his official report to the house of delegates one year ago, the chairman of the committee on organization, after reporting the splendid results of his labors during the year, said:

The real test of our organization will come in each state when the first out-burst of enthusiasm has passed, and county societies, the foundation for everything, are likely to disappear as rapidly as they have been formed, unless their usefulness to the rank and file of the profession can be demonstrated in a very broad way.

In recognition of this fact, it is of the utmost importance that the personal attention so effectively given to this work throughout the states by the chairman of the committee be continued.

MEDICAL EDUCATION.

When the American Medical Association was founded in May, 1846, the delegates assembled in response to the following preamble and resolutions of the Medical Society of the State of New York:

WHEREAS, It is believed that a national convention would be conducive to the elevation of the standard of medical education in the United States, and

WHEREAS, There is no mode of accomplishing so desirable an object without concert of action on the part of the medical societies, colleges and institutions of all the states, therefore be it

Resolved, That the Medical Society of the State of New York earnestly recommends a national convention of delegates from medical societies and colleges of the whole union, to convene in the City of New York, on the first Tuesday in May, in the year 1846, for the purpose of adopting some concerted action on the subject, set forth in the foregoing preamble.

From this it is apparent that this association was founded with the avowed and specific purpose of elevating the standard of medical education in this country. This subject has constantly received consideration from the association throughout the years of its existence; and while no distinct and positive reform marks its action, the perpetual demand for improvement undoubtedly molded the public sentiment of the profession which ultimately stimulated action on the part of the medical colleges. Since the addresses of my two distinguished predecessors, who immediately preceded me in this chair, were devoted to the consideration of medical education, I shall only make brief allusion to this subject. The several national organizations and the many state boards which are now dealing with this important professional problem invest the changing conditions with peculiar interest. The present is a transition period in the advancement and reform of medical education in America.

The consideration of this subject in the house of delegates culminated in the establishment last year of the council on medical education of the American Medical Association. During the past year the council has taken up its work with exceptional energy and good judgment, and is directing its efforts along most practical lines. The first annual conference was held in Chicago, April 20, last. Representatives of many state examining and licensing boards, of the American and Southern Medical Colleges associations, and of the government medical services, attended and participated in the discussions of the papers presented. The plan and scope of the work of the council can be best appreciated by a consideration of this extract from the address of the distinguished chairman of the council delivered to the conference:

What we need is cooperation, especially the cooperation between the medical profession, represented by the American Medical Association, and the state and county medical societies, and the state authorities, represented by the state licensing and examining boards. The most important question, therefore, before this conference is, How can the American medical profession and the state licensing bodies cooperate to elevate and control medical education? It is believed that such cooperation is possible. In such cooperation it will be the function of the American Medical Association to represent and possibly mold the opinion of the medical profession, and employ its influence and the influence of the county and state medical societies in obtaining proper medical legislation. In such cooperation it will be the function of the

state licensing bodies to protect the interests of the public and the profession by seeing that the medical laws are properly interpreted and enforced, and from their intimate knowledge with the medical acts they can often be of service in securing or modifying medical legislation.

It is not the purpose of the Council on Medical Education of the American Medical Association to attempt to arrogate to itself any special powers, nor does it desire either to criticize or interfere in any way with any of the agencies which are already in the field. If its creation is to result in good, it must be the means of obtaining cooperation between the medical profession, and the medical schools, the colleges of arts, the state examining boards, the government services, and all the factors which are interested in elevating and controlling medical education.

By securing cooperation of the various state and national bodies engage in this important work, recognizing the varied interests involved in the numerous states of the union, and fostering an intelligent public sentiment, so essential for every great reform, the influence of the association will be of the most effective character.

MEDICAL LEGISLATION.

Chapter VII., Section 3, of the by-laws provides a permanent committee on medical legislation 'to represent before congress and elsewhere the wishes of this association regarding any proposed legislation that in any respect bears on the promotion and preservation of the public health, or on the material or moral welfare of the medical profession.' This committee was appointed in 1903, and under the leadership of its accomplished and energetic chairman proceeded at once to organize the auxiliary committee provided in the by-laws. This being a permanent committee, its work will be continued from year to year. With the auxiliary committee, representing every state in the union, and the several medical departments of the government service, every representative of the people in congress can be reached directly. The importance of this work is so apparent that I need only call attention to it at this time, and urge on all members of the association the necessity of aiding and cooperating with the committee at all times. The disregard of the good work of the medical profession in the public service (to say nothing of the indignities offered) on the part of congress is notorious; and it is only by such concentrated power of the profession, intelligently directed, that such injustice may be overcome. I commend to your consideration the report of this committee in order that you may appreciate the important work already projected.

COUNCIL ON PHARMACY AND CHEMISTRY.

The use of proprietary medicines in the treatment of diseases has become one of the most confusing and demoralizing questions of the day. All proprietary medicines must not be classed as secret nostrums, for there are many honestly made and ethically advertised proprietary preparations that have therapeutic value and that deserve the approval of the medical profession. But there are many preparations offered the profession, which are protected by copyright or trade-mark, with formulæ more or less fictitious, and for which are made extravagant claims, which are in fact secret remedies. These preparations are so exploited by the manufacturer that the physician is persuaded to use them instead of writing a prescription; and since they usually bear popular names and plausible therapeutic claims, they appeal to the fancy of the laity. The field is an enticing one for commercial enterprise since these preparations in many instances are simple mixtures and contain the most inexpensive drugs. The use of such remedies is both unscientific and unjust, alike to physician and to patient.

The separation of the legitimate pharma-

ceutical preparations from the class of fraudulent nostrums described is a most difficult undertaking. This perplexing problem forced itself from year to year on the attention of the board of trustees in the effort of the board to keep the advertising pages of the *Journal* free from unethical advertisements. In order to have thorough protection and to make no unjust discrimination, the board has established the council on pharmacy and chemistry to make the necessary investigations. The council is composed of pharmacists and chemists of national and international reputation. It will be the aim of the council to publish in book form, a list of the preparations which are not officinal, yet which conform to the proper ethical standard. The work of the council will be similar to that of the Committee on Revision of the United States Pharmacopeia.

The magnitude and importance of this work is such that I desire to direct attention to it here, and to commend it to the members of the association as deserving every possible aid and advancement. It is the only practical way to deliver the profession from one of the greatest curses that ever came on it.

It has been my endeavor on this occasion to outline the plans of the founders of the association, briefly to trace the evolution of those plans throughout half a century of progress, and to recount some of the purposes that invite our active exertions at the present time. From a small body of delegates our association has increased until it is now the largest medical organization in the world. It owns valuable property, has accumulated a considerable fund, and has a large annual income, all of which belongs to, and is subject to the control of, the members who through their delegates select the board of trustees to manage their funds.

The possibilities of the work before us are almost beyond calculation. In acting as the representative and agent of the 120,000 physicians of the United States, the association is assuming great responsibilities, which will increase from year to year. It will require administrative and executive ability of the highest order to meet these demands; but there is both prophecy and proof in the work already accomplished that men will appear as needed to discharge the supreme duties of a great profession in behalf of science and humanity.

LEWIS S. MCMURTRY.

LOUISVILLE, KY.

THE RELATION OF PHYLOGENESIS TO HISTORICAL GEOLOGY.

FEW persons would be so bold as to offer serious objection to the great thesis of evolution, to the theory of common descent or to that of the competitive struggle of individuals and species for existence and its selective results, so ably enunciated by Darwin half a century ago. It is, nevertheless, true that of late years there has been an increasing distrust of the theory of the origin of species by natural selection which he therewith proposed, and which was long universally accepted with even less reserve than the author himself expressed. This distrust is especially felt in endeavoring to apply the latter theory to certain lines of paleontological investigation. A number of selected facts are stated at some length on following pages which show abundant reason for regarding that theory unfavorably in such cases. It is there shown that genera, families, orders and classes of animals and plants have, during geological time, usually originated with such comparative rapidity as to make it necessary to infer that species have originated suddenly; that the ratio of progressive development in the different faunal and floral divisions

has not only not been uniform during geological time, but that it has been exceedingly diverse; that those genera, families, orders and classes which have become extinct have, in many cases, declined and perished amid general conditions of physical environment which were evidently quite as favorable to their existence as were those amid which they originated; that certain generic and family forms have survived unchanged through vicissitudes and restrictions of habitation so adverse as to have been again and again apparently more than sufficient for their utter destruction; and that unknown determinate natural causes have acted, sometimes in the destruction, sometimes in the conservation, and sometimes in the extreme differentiation, of typical forms of life, often in seeming independence of environing physical conditions. In making application of those facts it will be shown that some theory of the rapid or sudden origination of species is necessary to harmonize them with the past conditions which they reveal. That the theory of the origin of species by natural selection will not harmonize with those facts will be made sufficiently plain by comparing each of them with the following statement of the chief features of that theory.

That is, that species originate from one another genetically by a process of transformation which requires indefinite time for its accomplishment, and which is, therefore, too slow for actual observation. Such transformation is the result of cumulative repetition, from generation to generation, of small variations such as always prevail in organic forms, until varieties, races, and then species, are produced and the higher groups which they compose are established. Variation is induced and its specific results conserved by physical conditions of environment as a dominant influence and by the struggle for existence under which the comparatively few fittest individuals survive and the infinite number of weaklings, which are born of individuals of all species, perish. Species, therefore, have no definite entity, even when fully developed, but are constantly changing toward the production of other species.

Three of the assumptions which are made by the advocates of this theory are plainly inconsistent with the facts which are presently to be stated, and they only will be discussed on the present occasion. One of them requires the paramount influence of physical conditions of environment for the origination of species and in the conservation of the higher groups which they constitute. One demands immeasurable time for the production of a single species, and consequently the lapse of illimitable time since the beginning of life upon the earth. The other implies that species have no existence as such, but that all of them are in a state of constant change. These assumptions will be separately considered further on.

The accompanying diagram is presented for the purpose of illustrating some of the principal facts that are mentioned in the statements which are to follow.

The horizontal spaces of the diagram represent the respective ages of geological history as they have been determined by the presence and characters of the fossil remains found in their strata. The perpendicular lines represent the principal great groups of animals and plants whose remains are found there. Thus the five lines under *A* represent the five subkingdoms of marine invertebrates, the Protozoa, Cœlenterata, Annuloida, Annulosa and Mollusca. The left-hand line under *B* represents the non-marine, and the right-hand line the land, invertebrates. *C*, fishes; left-hand line, selachians; right,

teleosts. *D*, batrachians and reptiles; left-hand line batrachians; right, dinosaurs; middle, all other reptiles. *E*, birds, single line. *F*, mammals; left-hand line, non-placental; right, placental. *G*, land plants; right-hand line dicotyledons and palms; left, all other kinds. The dotted portion of a part of those lines indicates some doubt as to the epoch in which the kind represented by such a line was introduced.

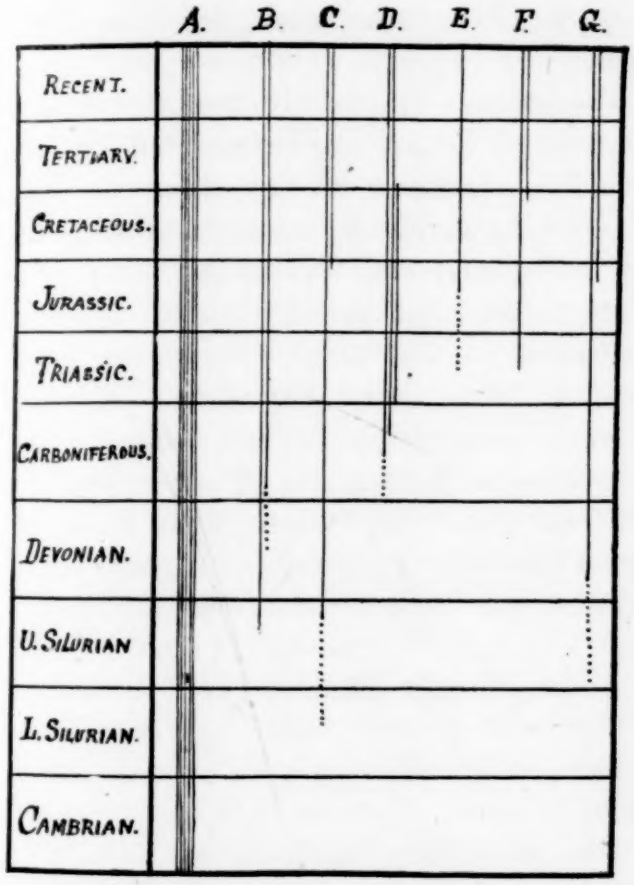

DIAGRAM SHOWING TIME-RANGE OF CHIEF-KINDS OF ANIMALS AND PLANTS.

A, marine invertebrates; *B*, non-marine and land invertebrates; *C*, fishes; *D*, batrachians and reptiles; *E*, birds; *F*, mammals; *G*, land plants.

This diagram thus represents the earliest known epoch of existence of each of the principal kinds of animals and plants, and their continued existence through subsequent geological time. It is a significant fact that, so far as can be judged by their fossil remains, every kind represented on the diagram began its existence with a comparatively high grade of its own types of organization. The instances which will be presented in support of the propositions that were stated in the opening paragraph of this article will necessarily be disconnected in their statement because, in an article like this, there is only opportunity to consider some of the more striking facts selected from a multitude.

The strata of lower Cambrian age contain remains of the earliest forms of life that are known to have existed upon the earth.[1] Large series of rocks, more or less distinctly stratified like those of Cambrian age are, in some regions, found underlying the latter; but no classifiable fossil remains have been found in them, and little evidence has been discovered that life existed before the Cambrian age. The fossil remains which are found in the Cambrian strata pertain to all five of the invertebrate subkingdoms, the vertebrata only being absent; and remains belonging to each of those five subkingdoms are found in all, even the lowermost, of the Cambrian formations. Representatives of those five subkingdoms have continued to exist through all the subsequent ages to the present time in ever-varying forms within the limited scope of their faunal rank, but those representatives were evidently connected by continuous genetic lines, as is represented under *A* on the diagram. So little change is found to have occurred in the general organic rank of those subkingdoms that one may justly assume nearly as high grade for the earliest as for the latest members. Those earliest known animal types either originated with comparative suddenness and then continued through subsequent

[1] For the present occasion I treat the reported fossiliferous Algonkian rocks of Utah and Montana as not older than the lower Cambrian; but even if they are really older, that fact will not affect the validity of my argument, except to enforce it.

time with their chief characteristics unchanged, or they originated in some far distant age of pre-Cambrian time and reached their now known earliest stage of evolution quite as slowly as they have changed since they reached that stage. Aside from the absence of evidence in favor of the latter supposition, it is an improbable one in view of that extremely slow increase of faunal rank in those subkingdoms which has just been mentioned. To indicate that slow increase of faunal rank we may postulate a pair of chronological lines extending from the Cambrian age to the present time as the two sides of an evolutional angle of parallax. The divergence of such a pair of lines would be so exceedingly small that the apex, which would represent the beginning of life, will be carried back into the abyss of time to a point inconceivably remote. It, therefore, seems necessary to conclude that the earliest Cambrian faunas had a comparatively sudden origin, notwithstanding the fact that their development diverged so slowly through subsequent time.

A case partly similar to the one just stated, but which is of narrower faunal scope and shorter chronological range, is presented by the Unionidæ, the oldest certainly known fossil remains of which family are found in Triassic strata.[2] Similar remains are also found in successive formations to the present time, living representatives of the family being abundant in the lakes and rivers of the world. The genus *Unio*, the typical member of that generically small family, is thus known to have existed continuously and unchanged during all that stretch of time in which all the mammals, all the birds, all the teleost fishes, and all the exogenous plants of the earth were introduced, and in which the dinosaurs culminated and became extinct. These earliest representatives of the Unionidæ are fully characteristic of the family, but no certain trace of any previously existing member of it has been found in any older strata. It seems necessary to assume that this family, by its typical genus, was suddenly introduced at that early period, and that it has remained without material change through all the subsequent ages.

One may suggest that the marine invertebrates, which are represented by the five lines under *A* on the diagram, have preserved their faunal integrity through all the geological ages because they had a continuous congenial marine habitat. But the fresh-water invertebrates have survived with quite as little change without such obvious advantages. For example, the Unionidæ were from age to age subject to shifting and adverse conditions resulting from the changing relations of lands and waters, and from the restriction and isolation to which all fresh waters are subjected by intervening land. Their habitable range was also restricted by the marine waters into which their congenial fresh waters flowed. If physical conditions of environment were the dominant factors in phylogenetic differentiation we should expect that these and other faunal groups of fossil fresh-water mollusca would have become widely and profusely differentiated. As a matter of fact, however, those diverse and frequently changing conditions did not result in great differentiation of fresh water faunas in general, a fact which is of importance in this connection. On the contrary, all fresh-water faunas are notably much less diversified than are marine faunas; and fresh-water mollusca especially have retained their primitive types through long geological ages under the

[2] Those Devonian shells which were referred by Vanuxem to *Anodonta*, the several species of the Naiadites of Dawson, and other paleozoic shells, I do not now regard as belonging to the Unionidæ.

vicissitudes just mentioned. Moreover, the most ancient types found among living fishes are denizens of fresh, and not of marine, waters. This fact indicates that the genetic lines of those ichthyic types also were not wholly broken by such shifting physical conditions, and that the genetic lines of their marine congeners were not preserved by having less restricted and more uniform conditions of environment.

The chief object of the immediately preceding paragraph is to show the strong contrast between the conditions which have attended the genetic descent of fresh-water and marine faunas respectively. By way of explanation it is proper to say, however, that the only manner in which unbroken genetic lines of fresh-water faunas could have been preserved through the geological ages to the present time is through unbroken fresh water conditions. Such conditions could have been preserved only by the persistence of rivers in their established channels, so that at least some portions of them, together with their faunas, have escaped destruction by all subsequent elevations and depressions of land surface.[3]

During the Triassic and Jurassic periods the genus *Unio* was the only known representative of its family, and it has always been the leading genus of that family since those periods. This fact shows that, contrary to a prevailing belief, rare genera are not always disappearing or decadent genera. It is also worthy of remark in this connection that although genera were sometimes so long-lived, the geological record shows that the duration of species was comparatively short. The sudden introduction of the Unionidæ by its leading genus, *Unio,* without known congeners, and its survival unchanged through all subsequent ages under peculiarly adverse conditions, are all inconsistent with the theory of the origin of species by natural selection. They are also inconsistent with the assumption that the influence of physical conditions of environment has been a constant dominant factor in phylogenetic differentiation, on the one hand, and of conservation of established living forms on the other.

The earliest known remains of the great subclass of dinosaurian reptiles are found in early Triassic strata, and the latest known representatives of that great subclass barely survived the close of the Cretaceous period, as is shown by the presence of their remains in the upper strata of the Laramie formation, associated with animal and plant remains belonging to Tertiary types. The beginning and end of the comparatively short time range for such a large and diversified subclass of dominant and distinctive animals is shown by the right-hand line under *D* on the diagram. Those strangely peculiar animals were introduced suddenly, soon existed in multitudes, became dispersed over the earth with great rapidity and, from their beginning, they were the dominant animals of all the continents. They varied in size from that of a rabbit to that which would be equal to several large elephants; and the grade of organization for the whole subclass was as high in the earlier as in the later part of its existence. They were differentiated into flesh eaters and plant eaters and into denizens of land and water respectively. We know absolutely nothing of the genetic origin of those remarkable animals, and no traces of similar animals have been found in any strata older than those containing their early Triassic remains. Their world-wide decadence was not delayed by the improving earth-conditions which the mammalia, soon to assume faunal dominion, found abundantly con-

[3] See my discussion of this subject in Third Annual Report of the U. S. Geological Survey, pp. 479–486.

genial; and the last of their kind perished so utterly at, or immediately after, the close of the Cretaceous period that the earth has since contained no living representative of any of them.

I once tried to account for the sudden disappearance of the dinosaurs by supposing the coalescence of continental areas which they occupied with others upon which powerful Eocene mammals had been separately introduced, assuming that the final destruction of the dinosaurs occurred in the fierce conflicts which would naturally follow. But such a suggestion presupposes the contemporaneous existence, in separate regions, of highly organized and characteristic Mesozoic and Tertiary vertebrate faunas, which one is naturally slow to believe. The occurrence of such continental changes has not been proved, and no paleontological battlefields, with mingled remains of the mighty combatants, have ever been discovered. It seems impossible to conceive of the applicability of the theory of the origin of species by natural selection to any of the chief features of the strange faunal history of the dinosaurs, or to their sudden origination and extinction.

We know little or nothing of the ancestry, or of the genetic succession of the unique, abundant and universally distributed flora of the Carboniferous age. It differed materially in character from that of the flora which preceded it, and it was even more different from all succeeding floras. Its forms were so diverse, and their family characteristics so distinctly defined, that the idea of such a gradual transition from one to another as the theory of their origin by natural selection requires seems to be wholly inadmissible.

The palms and exogenous trees, represented by the right-hand line under *G* on the diagram, were introduced with apparently great suddenness in late Jurassic time, and those earliest known plants of their kinds had essentially the same grade of organization that those kinds now possess, although their subsequent evolution has been comparatively slight as regards floral rank.

Birds, having unmistakably reptilian characters, are known by their remains to have existed in the Jurassic and Cretaceous periods; but remains of the earliest known true birds, such as are referable to any of the living orders, are found in strata of the Eocene Tertiary, and they seem to have originated suddenly in that epoch. These, and all living birds, differ greatly from those older kinds, and no intervening kinds have been discovered. It is true that in this case, as in other similar cases, the paleontological record is far from complete, but the epochs in which the older and later forms, respectively, are known to have existed were apparently separated by a time interval which was much too short to have produced such wide differences by the slow process of natural selection.

Remains of the earliest known teleost fishes are found in latest Jurassic and early Cretaceous strata. They were structurally very different from all known earlier fishes and possessed in full the distinguishing characteristics of the teleosts as they exist to-day. To say that no evidence of the gradual and slow evolution of the teleost fishes from older and very different ichthyic forms has ever been discovered is but to repeat what has been said of the sudden appearance of other highly organized forms.

A similar degree of suddenness marks the introduction of the placental mammalia, which occurred about the beginning of Tertiary time, as is shown by the right-hand line under *F* on the diagram. Those highly organized animals assumed faunal

dominion of the earth, which the decadent dinosaurs had departed from. They came in a great diversity of forms, and their organization was little if any inferior in rank to that of the mammals now living of lower grade than the quadrumana. There has been found no evidence of their evolution from earlier forms by any slow process, not even from the previously existing non-placental mammals; and their species all became extinct at, or before, the close of the Eocene epoch. They were then replaced by the Miocene and Pliocene mammalia respectively, each fauna containing many strange and suddenly introduced forms, and each losing largely by extinction. Indeed, the history of the mammalia from the earliest Tertiary to the present time embraces a record of the rapid and varied evolution of the highest grades of animals, culminating in man. If it should ever be possible to trace the evolution of man from the lower animals it will doubtless be found that it has been accomplished, not by the slow process of natural selection, but by a series of sudden mutations.

In the foregoing remarks the terms rapid and sudden, referring to the introduction and extinction of the larger divisions of faunas and floras, are sometimes used in a comparative sense, and sometimes literally. The latter use of those terms, however, is more especially made when referring to species. If the introduction of families, orders and classes, and even of entire faunas and floras, was so effected as to give the appearance of suddenness, or even of rapidity, it necessarily follows that species, which are the recognized component units of those greater groups, were produced with actual suddenness.

The necessity for assuming the sudden origin of species being apparent, the first question that naturally arises is that of the manner of their origination. This must have been accomplished either by special creation, as was formerly believed, or by some natural genetic process of transformation. The time seems to have passed for giving any consideration to the former proposition, and it only remains to consider some natural theory. While many expressions of belief have from time to time been made that species have originated suddenly by some natural process, the only clearly defined theory of this kind is the one proposed by Professor de Vries, of Amsterdam, under the name of the mutation theory.[4] It is essentially as follows:

Species originate from other species through the ordinary function of reproduction, but they each originate suddenly and completely by one mutative act, and not by the slow cumulative variation of individuals. The beginning of the mutative process, which is due to some at present unknown natural determinate cause, is a rearrangement of the groups of component molecules of the protoplasmic contents of the germ cell. It occurs when the ovule containing that cell has, by the natural process of reproduction, been fertilized and is about to give origin to a new individual. If that molecular change occurs, the new individual thereby acquires changed structural characters and becomes an original representative of a new species. If no such molecular change occurs in the germ cell of a fertilized ovule, which is usually the case, the result is only that of ordinary reproduction. The new species thus produced by mutation is in immediate possession of clearly distinguishing and heritably transmissible characters; and it has no more tendency to hybridize with any member of the mother species than have other species. The characteristics and perpetuation of the mother species are in no way affected by

[4] 'Die Mutationstheorie,' von Hugo de Vries, Vols. 1 and 2, Leipzig, 1901, 1902.

the mutative birth of one or more of her progeny.

Species thus produced by mutation are called elementary species. They differ distinctly but not widely from the mother species; wide differences result from the absence of intermediate elementary species. That is, the daughter species become mother species successively; a large part of the mutated, as well as of the ordinary, offspring soon perish in the struggle for existence, even with their own kindred, until wide differences between species of the same stock result. Species are destroyed in the struggle for existence, but that struggle plays no part in their origination.

That species have a real entity and, for the most part, an essentially unchanging existence, are facts of daily observation. They are born, and if they survive the struggle for existence to which they are immediately subjected, they usually have an extended duration; but they finally perish. The duration of a species has two periods, a mutative and a non-mutative period; the former being exceedingly short in comparison with the latter. So very much is the non-mutative period of all species in excess of the mutative, that all the species living in any large region at any given time are likely to be in the non-mutative condition. Furthermore, the process of mutation is so inconspicuous that it may easily escape detection. Attention is particularly called to the fact that mutation, using that term in its here adopted special sense, is as much a natural and normal process as is that of ordinary reproduction, with which function every case of mutation is concurrent. It is also in no way opposed to the great thesis of evolution, and is in full accord with Darwin's theory of common descent.

By referring to the three assumptions of the advocates of the theory of the origin of species by natural selection which are mentioned in the early part of this article, and comparing them with the immediately preceding statement of the mutation theory, it will be seen that this theory is directly opposed to them, but consistent with the facts which have been stated in preceding paragraphs. By further referring to those statements it will appear that in all the cases wherein the inapplicability of the origin of species by natural selection has been shown, the mutation theory is fully applicable. Indeed, the applicability of the latter theory is so apparent that only the following brief comments will be made in conclusion.

The assumption of an illimitably remote period for the beginning of life upon the earth, which the theory of the origin of species by natural selection requires, and which has been vigorously opposed by physicists as inconsistent with cosmical law, is shown by the mutation theory to be unnecessary. That question is, therefore, eliminated from all such discussions because the mutation theory presupposes a rapidity of evolution that would bring the beginning of life quite within the limits required by the physicists.

The comparative rapidity of introduction and dispersion upon the earth of certain genera, families, orders, classes and even of great faunas and floras, makes it necessary to infer the sudden origin of their elementary component units. Those facts and the inference mentioned are as consistent with the mutation theory as they are inconsistent with the theory of the origin of species by natural selection. Furthermore, the persistence of those faunal and floral groups through long periods of geological time with little change after they had become established, makes it necessary to infer the stable entity and

heritability of species. Such an inference accords with the requirement of the mutation theory, but not with the theory which requires perpetual change in all species.

Certain groups of animals and plants have continued their existence without material change under very adverse conditions of physical environment which were seemingly more favorable for their existence than were those under which they originated. The theory of the origin of species by natural selection is at variance with such facts because it recognizes environing conditions as a constantly dominant factor in producing phylogenetic changes, on the one hand, and in preserving the integrity of faunal and floral types, on the other. The mutation theory recognizes the initiative action of an at present unknown determinate natural cause for phylogenetic changes. Environing physical conditions have doubtless been a potent cause in producing variations; and it has doubtless often had a controlling influence upon the destiny of faunas and floras; but such conditions have not been a direct factor in the origination of species.

Whatever criticisms may be made of the de Vriesian theory of mutation, the truth will remain that it accords with numerous important facts with which the theory of the origin of species by natural selection is quite inconsistent. Some theory which provides for the sudden, or rapid, origination of species is made necessary by a large array of geological facts, and the mutation theory more nearly meets that demand than does any other yet proposed.

CHARLES A. WHITE.

SMITHSONIAN INSTITUTION,
February 20, 1905.

SCIENTIFIC BOOKS.

Introduction à la Géométrie Générale. Par GEORGE LECHALAS, Ingénieur en chef des ponts et chaussées. Paris, Gauthier-Villars. 1904. Pp. ix + 58.

The Elements of Plane and Solid Analytical Geometry. By ALBERT L. CANDY, Ph.D., assistant professor of mathematics in the University of Nebraska. Boston, D. C. Heath & Co. 1904. Pp. x + 248.

The Elements of Analytic Geometry. By PERCEY F. SMITH, Ph.D., professor of mathematics in the Sheffield Scientific School, Yale University, and ARTHUR S. GALE, Ph.D., instructor in mathematics in Yale College. New York, Ginn & Co. 1905. Pp. xii + 424.

An Introduction to Projective Geometry and Its Applications. By ARNOLD EMCH, Ph.D., professor of graphics and mathematics in the University of Colorado. New York, John Wiley & Sons. 1905. Pp. vii + 267.

Descriptive Geometry for Students of Engineering. Second edition. By JAMES A. MOYER, S.B., A.M., instructor in descriptive geometry in Harvard University. New York, John Wiley & Sons. 1905. Pp. iv + 198.

The Elements of the Differential and Integral Calculus. By DONALD F. CAMPBELL, Ph.D., professor of mathematics, Armour Institute of Technology. New York, The Macmillan Company. 1904. Pp. x + 364.

Elements of the Differential and Integral Calculus. By WILLIAM A. GRANVILLE, Ph.D., instructor in the Sheffield Scientific School, Yale University. New York, Ginn & Co. 1904. Pp. xiv + 463.

The Boston Colloquium: Lectures in Mathematics. By EDWARD B. VAN VLECK, HENRY S. WHITE and FREDERICK S. WOODS. New York, The Macmillan Company. (For the American Mathematical Society.) 1905. Pp. x + 187.

Except the last these works are all of them addressed to beginners in their respective subjects, and, except the first and last, they are designed for use as text-books in undergraduate study.

The aim of Lechalas's splendid essay is orientation among the fundamental divisions of modern geometry conceived in full generality. Especially intended for such as have not formed a systematic conception of the Euclidean, Lobatchevskian and Riemannian

theories, the motivity and principles of classification are presented in fresh and simple fashion, and the three grand types are made to appear vividly in their true light as together constituting a single exhaustive geometric unit or whole. To this end it is shown, in an introductory chapter, by easy considerations connected with symmetry, reversibility (*retournabilité*) and curvature, that the concept of super-dimensional spaces is logically indispensable. The second chapter accordingly deals with the concept and certain illuminating properties of Euclidean space of four dimensions. The essay closes with a third chapter devoted to analogous features of the geometry of spaces of negative curvature. From the simplest and most familiar considerations to the most remote and recondite, the reader is conducted swiftly and along geodesic paths, but the scenery along the way is rich and stimulating. We take pleasure in recording our judgment, independently formed and concordant with the author's, that the geometry of hyperspace is, at least for certain temperaments, genuinely geometric and not merely analytic as some have claimed. The notion of hyperspace, indeed, rests upon spatial intuition, and the higher spaces that reason has created, the imagination may very well yet learn to picture and illuminate. To those who may aspire to a reasonably competent acquaintance with the elements of *general* geometry, we commend this little book along with Jouffret's 'Traité élémentaire de Géométrie à quatre dimensions,' from which the former draws to some extent, Schubert's essay on fourfold space in his 'Mathematical Essays and Recreations,' and 'Mehrdimensionale Geometrie' by Paul Schoute.

The late Judge Cooley was accustomed to advise his students never to buy a law book not provided with an index. It would be harsh to apply that maxim to Professor Candy's book, for, though it lacks the feature mentioned, it contains others which make it one of the very best among the works of its class. We refer particularly to its emphasis upon the general analytic method as distinguished from limited methods especially available for the conics, and to its fusion and simultaneous treatment of algebra, geometry, equation theory, analytics and calculus, as contrasted with the usual practice of presenting these subjects separately in succession and of so giving the injurious impression that they are as so many separate instruments, or insulated departments, of thought. In the respects indicated we believe the book will prove to be something of a pioneer.

Doctors Smith and Gale 'have endeavored to write a drill book for beginners which presents the elements in a manner conforming with modern ideas.' But these words are obviously not to be taken quite literally. For, on the one hand, a book that is relieved by such live and life-giving topics as invariants, parametric equations, conic systems, homothetic, similitude and symmetry transformations, inversion, systems of orthogonality, poles, polars and polar reciprocation, can hardly be adequately described as a mere drill book; and, on the other hand, its modernity, for it is modern in many respects, would have been, in our judgment, not a little improved by a bold introduction and use of the infinite elements and by allowing imaginaries to play conspicuously their familiar enlightening rôle. It is true that imaginary elements are not properly intuitable; they lack the property of definitely localizable exteriority, and on that account they tend to confuse at first, but only at first, and afterward they give a light which, if it be invisible to sensuous vision, reason at all events demands. We do not believe in the subordination of the intelligence to sight and imagination. It is to the *rational* spirit, which beholds many things inaccessible to the ordinary imagination, that analytic geometry, strictly and properly conceived, addresses itself. And in this subject, the languages of analysis and geometry should be coextensive. We are glad to note that in this work, as in Candy's, the accent falls upon the general analytic method rather than on specific curves, as those of second order. The book abounds in concepts, and these after all are the constituents of intelligence. These being well formed, ratiocination is easy, while without the former the latter is empty and vain.

Professor Emch's book is avowedly utilitari-

an in its aim. Just on that account, it meets a need long distinctly felt in its field. It does not seek to rival in their own way the logicians and 'arithmetizers,' or the purists like von Staudt, or the Italian geometer-ontologists like Veronese, or the 'visualizers' like Enriques. It is more in the spirit of such as Poncelet, Steiner and Chasle, who were less concerned with foundations, which to them were obvious enough, than with superstructure. But it is in no sense a slavish imitator of any type or school. It has a way of its own, and it is refreshing in these peering microscopic days to find your cruder intelligence enlisted without ado, to be ushered at once into the midst of things and in course of the first score of pages to find the atmosphere charged with such cardinal notions as anharmonic ratio, involution, projective transformation, and projective and involutoric pencils and ranges. A second chapter deals with 'Collineation,' a third with 'Theory of Conics,' a fourth with 'Pencils and Ranges of Conics and the Steinerian Transformation in Connection with Cubics,' and a final chapter of forty-five pages with 'Applications to Mechanics.' The method, consistently with the emancipated spirit of modern geometry, is now analytic, now geometric and now a combination of them. For the pure mathematician as such, Professor Emch's book can not be regarded as a substitute for the Cremona and Reye classics, but it will serve for much more than an admirable introduction to them. It differs from them in spirit, content and method. The exposition of the interesting connection between collineations and the surprisingly beautiful doctrine of linkages deserves special mention, as do also the clearness, directness and swiftness of style in which the book is written.

Mr. Moyer has not aimed to write for the geometrician, but for the student of practical engineering. Hence his book does not say that, if such and such propositions be granted, such and such others will follow as logical consequences. It says, if you desire certain specified results, you should proceed thus and so. From some points of view, it seems a pity that such important practice should be so divorced from the theory which constitutes its ground and rational justification. Such detachment, however, is not fatal. The Romans were but meager mathematicians, but they were excellent engineers in their day. Nevertheless we believe that the interests of both theory and practise would be better served if the instruction offered by Mr. Moyer were combined with such a course as that afforded by Professor Emch's book. The time element has of course to be reckoned with. Mr. Moyer's experiment of adopting the notation of mechanical drawing and of introducing many concrete graduated exercises has been eminently successful and these features have been retained in the second edition.

The above listed books of the calculus are evidently, both of them, products of conscientious workmanship. Both of them were composed in the composite light of teaching experience and of modern knowledge of the subject. Guided by the needs of his own classes and therefore excluding all topics not directly bearing upon engineering, Professor Campbell has been enabled, without making his book large or cumbrous, to give a brief introduction to mechanics and differential equations and at the same time to dwell upon fundamental notions and processes. In this last regard, his painstaking and repeated explanation of the way in which summations and integrals are constituted deserves especial mention. Though written primarily for technological students, the book is far from ill-adapted to the uses of so-called more liberal institutions. Professor Granville's work is of larger range, embracing not only the subjects specially adapted to the needs of the student consciously destined for work in applied science, but also those that particularly appeal to the student looking towards specialization in pure mathematics. As well in its scope as in its spirit, the work is distinctly more than the author modestly styles it, 'essentially a drill book.' We especially like its graphic treatment of limits and continuity and its constant appeal to intuition as an indispensable aid to analysis. The geometric and physical illustrations of the significance of the integration constant are happy, to mention a single

feature. Commendable also is the effort throughout to render clear the *meaning* and *limitations* of cardinal theorems. We doubt, however, whether the vexed question whether a variable may attain its limit is, in spirit, quite settled by the ingenious example given on page 20.

The Boston Colloquium consists of three sets of lectures: three by Professor White on 'Linear Systems of Curves on Algebraic Surfaces'; three by Professor Woods on 'Forms of Non-Euclidean Space'; and six by Professor E. B. Van Vleck on 'Selected Topics in the Theory of Divergent Series and Continued Fractions.' The lecturers being all of them former pupils of Professor John Monroe Van Vleck recently retired from the chair of mathematics and astronomy at Wesleyan University, where he had served for a period of fifty years, this volume of lectures is inscribed to him. Each set of the lectures affords a compendious account of the advanced thought in its field, together with indications of existing problems and of the directions that further immediate developments will probably follow. The lectures being of highly technical character and being addressed to specialists, any adequate account of them must be reserved for journals specifically devoted to mathematics.

Cassius J. Keyser.
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Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus herausgegeben von Professor Dr. G. Hellmann. No. 15 (Schlussheft). *Denkmäler Mittelalterlicher Meteorologie.* Berlin, A. Asher & Co. 1904. 4to. 46 pp. introduction + 270 pp. reprints + 12 pp. addenda and errata to previous numbers.

The publication of this volume, which is the fifteenth and final one of the series, affords an opportunity to congratulate Dr. Hellmann on the completion of so admirable a bibliographical work, which offers to students the advantage of reading in their original form many epoch-making papers relating to meteorology and terrestrial magnetism. Readers of Science are familiar with the nature of these reprints from the reviews that have appeared in Vol. I., p. 302; Vol. IX., p. 910; Vol. XIII., p. 821; and Vol. XVI., p. 352. Five of the earlier volumes demonstrated that meteorology was actively cultivated in the fourteenth, fifteenth and sixteenth centuries, but in the present issue it is seen that much earlier, and during the entire middle ages, meteorological questions were continually discussed. As illustrations there are given, in part or *in extenso,* 26 writings, dating from the seventh to the fourteenth centuries, inclusive, among them the following examples of famous authors: 'De Natura Rerum,' by Isidorus Hispalensis and Beda Venerabilis; two papers by Albertus Magnus; Roger Bacon's 'Opus Majus,' and 'De Proprietatibus Rerum,' by Bartholomæus Anglicus. Most of the treatises are taken from printed books, but a few are printed from manuscripts for the first time. Certain tracts that were written in little-known languages have been translated into German and so are made accessible to a wider circle of readers, but those in early French, Italian and Dutch appear in the original tongues. It is hardly necessary to say that the facsimile reproductions have been made with the same care that characterized Dr. Hellmann's previous reprints, for the accuracy of which the writer can vouch, having compared several with the originals in his own possession. Their value is much enhanced by the explanatory and bibliographical notes which accompany each.

One or two copies of this last volume have been placed on sale at the Blue Hill Observatory, Hyde Park, Mass., and will be sent on receipt of the publisher's price, viz., 28 Marks, or $7. In conclusion it may be stated that at least four of the earlier volumes are already out of print and command high prices.

A. Lawrence Rotch.

SCIENTIFIC JOURNALS AND ARTICLES.

The last number of *The American Journal of Mathematics* contains the following articles:

G. W. Hill: 'Deduction of the Power Series Representing a Function from Special Values of the Latter.'

SAUL EPSTEEN AND HEMAN BURR LEONARD: 'On the Definition of Reducible Hypercomplex Number Systems.'

PETER FIELD: 'Quintic Curves for which $P=1$.'

C. L. E. MOORE: 'Classification of the Surfaces of Singularities of the Quadratic Spherical Complex.'

LEONARD EUGENE DICKSON: 'Subgroups of Order a Power of p in the General and Special m-ary Linear Homogeneous Groups in the $GF[p^n]$.

THE introductory article in the May number of the *American Geologist* is a 'Biographical Sketch,' with portrait, of Benjamin West Frazer by Persifor Frazer. This is followed by Professor N. H. Winchell's article entitled 'Deep Wells as a Source of Water Supply for Minneapolis.' This paper, which is accompanied by several plates, is a presentation of the ever-interesting problem of the water supply of cities. Miss Owen discusses the 'Evidence on the Deposition of Loess.' R. R. Rowley contributes a paper on 'Missouri Paleontology,' which is illustrated by one plate of figures and three new species are described. The concluding article is by Professor Warren Upham on 'Fjords and Hanging Valleys.'

The Museums Journal of Great Britain for May notes that the principal subject for discussion at the coming meeting of the Museums' Association will be 'The Relation of Provincial Museums to National Institutions,' a topic to which American members can contribute little, as here there are no relations, save those of good feeling, each museum being independent of others. Under the head of 'A Notable Gift' is recorded the presentation to the British Museum of the reproduction of the skeleton of *Diplodocus carnegiei,* in the museum at Pittsburgh. Under 'Museum Thefts' is noticed the stealing of some Nelson relics from the Liverpool Museum, primarily due to the fact that a case was left unlocked for some months. Apparently English museums do not suffer from the petty thefts of 'relic seekers' who, in our own museums, take articles of little intrinsic but considerable scientific value, thus doing very considerable damage.

The American Museum Journal for April is called the *Brontosaurus* number, its principal topic being 'The Mounted Skeleton of *Brontosaurus*' recently placed on exhibition. Dr. Matthew tells how this skeleton was obtained, transported and mounted, and discusses the habits and habitat of this enormous brute as indicated by the bones. The two new bird groups, the flamingos and the bird life of the San Joaquin valley are also described and illustrated by full-page plates.

The Popular Science Monthly contains the folowing articles:

July.

PROFESSOR W. E. CASTLE: 'Recent Discoveries in Heredity and their Bearing on Animal Breeding.'

PROFESSOR J. LAWRENCE LAUGHLIN: 'Present Monetary Problems.'

H. TAYLOR EDWARDS: 'The Vegetable Fibers of the Philippine Islands.'

DR. GUSTAVE MICHAUD: 'The Climate of the Central American Plateau.'

PROFESSOR A. E. DOLBEAR: 'The Science Problems of the Twentieth Century.'

DR. HENRY RUTGERS MARSHALL: 'Human and other Forms of Consciousness.'

PROFESSOR ARTHUR A. NOYES: 'The Preparation and Properties of Colloidal Mixtures.'

August.

PROFESSOR CHARLES DILLON PERRINE: 'An Eclipse Observer's Experiences in Sumatra.'

PROFESSOR JOHN M. COULTER: 'Public Interest in Research.'

JOHN F. CARGILL: 'The Value of Old Age.'

PROFESSOR GEORGE T. LADD: 'A Suggestive Case of Nerve-anastomosis.'

PROFESSOR HUGO DE VRIES: 'A Visit to Luther Burbank.'

PRESIDENT WALTER NGON FONG: 'Some Phases of the Educational Problem in China.'

PRESIDENT KENYON L. BUTTERFIELD: 'The Social Phase of Agricultural Education.'

DR. W. H. MAXWELL: 'Education for Efficiency.'

'President Roosevelt's Address before the National Educational Association.'

SOCIETIES AND ACADEMIES.

THE OREGON STATE ACADEMY OF SCIENCES.

THE need of some general scientific organization has for a number of years been keenly felt by a number of teachers of science and

investigators in Oregon, who, by reason of their great distance from the scientific centers, are unable to attend the annual scientific convocations and congresses. Many other persons, also, who are not engaged professionally in scientific work have realized the need of organized effort in the interest of the development of the scientific resources of the state. In response to this spirit a call was issued by Mr. Edmund P. Sheldon, upon consultation with others, for a meeting to be held February 4, 1905, in the rooms of the John Burroughs Club, Portland.

At this meeting about thirty persons were present. Mr. Edmund P. Sheldon was elected temporary chairman; Dr. Drake, secretary. Plans of organization were discussed and a committee was appointed to draw up constitution and by-laws for an academy of science. Upon this committee were appointed Professor G. E. Coghill, Pacific University, chairman; Professor A. R. Sweetser, State University; Messrs. M. W. Gorman, Schmidt and Ross Nicholas, of Portland. A committee was appointed, also, to confer with the Lewis and Clark Centennial Exposition Commission with regard to arranging for a scientific congress in connection with the Lewis and Clark Centennial Exposition.

Following the business session a paper upon 'The Bacteriology of Water' was presented by Professor A. R. Sweetser. The paper included an account of the author's investigation of the water supply of certain cities and towns of the Willamette Valley. Special attention was given to the water supply of Portland, which was found to be exceptionally free from liability to bacterial contamination. A device for conveying specimens of water long distances at low temperature for bacteriological examination was exhibited and discussed.

The second meeting for organization was held February 18, Mr. Sheldon presiding; Professor C. E. Bradley, secretary. Constitution and by-laws were adopted, and the organization was formally completed under the name of 'The Oregon State Academy of Sciences.' The following officers were elected:

President—Edmund P. Sheldon, superintendent of forestry, fish and game, Lewis and Clark Exposition Commission.

Vice-Presidents—A. R. Sweetser, professor of biology, University of Oregon; A. B. Cordley, biologist of the Oregon Agricultural College; Catherine McConnell, teacher of chemistry and physiology, Portland High School.

Recording Secretary—J. A. Lyman, professor of chemistry, Portland Academy.

Corresponding Secretary—G. E. Coghill, professor of biology, Pacific University.

Treasurer—M. W. Gorman, botanist, Portland.

Librarian and Director of Museum—L. L. Hawkins, capitalist, Portland.

Trustees—L. L. Hawkins; Dr. James Withycombe, director of the experiment station of the Oregon Agricultural College; Edward A. Beals, U. S. Weather Bureau, Portland.

The constitution provides for monthly meetings, and for special meetings which will no doubt be held annually with a view to calling together the scientists of the northwest.

Two of the regular meetings have already been held. On March 18 a paper was presented by G. E. Coghill on 'The Taste Organs of Vertebrates.' On April 18 Mr. Edmund P. Sheldon read a paper on 'Forestry in the United States.' The paper considered the methods and aims of the forester, the significance of forestry to the nation, and to the state of Oregon especially. Mr. Sheldon's excellent treatment of the subject called forth a spirited discussion of our local and national methods of dealing with the forestry problem.

George E. Coghill,
Corresponding Secretary.

THE TORREY BOTANICAL CLUB.

The meeting of May 31 was held at the American Museum of Natural History, President Rusby in the chair and eleven persons present.

The first paper on the scientific program was by Dr. C. Stuart Gager, and was entitled 'Preliminary Notes on the Effect of Radioactivity on Plants.' Plants grown in the presence of radium are subject to four different influences: (1) The α-rays, composed of a stream of material particles bearing a charge of positive electricity; (2) the β-rays,

made up of a stream of particles 1/2000 the size of those of the α-rays and carrying a charge of negative electricity; (3) the γ-rays, analogous to X-rays, but much more penetrating; (4) the emanation, which in a process of 'decay,' gives off α-rays as described, and eventually the β- and γ-rays mentioned above. The emanation behaves as a very heavy gas and may be condensed on a solid surface at a temperature of —150° C. The influence of radium upon plants, therefore, is of the nature of radiant energy.

The radium was employed in the form of the salt, radium bromide, of three strengths of activity, 1,500,000, 10,000 and 7,000 enclosed in sealed glass tubes, and also in the form of celluloid rods and cylinders covered with Lieber's radium coating of 10,000 and 25,000 activity. The glass shuts off practically all the α-rays, the β-rays penetrate through the glass more easily, while the γ-rays pass through glass very readily. By the use of the coated rods and tubes all three kinds of rays are available as well as the emanation.

The experiments indicate that the rays act as a stimulus, which varies in intensity with the strength and amount of radium used, the thickness of the seed-coats, distance of exposure and the intervention of moist soil between the radium and the plant. If the stimulus ranges between a minimum and an optimum germination and subsequent growth are accelerated. Within these limits the rate of alcoholic fermentation is at first increased, but continued exposure may result in over-stimulation and consequent decrease in rate.

By over-stimulation germination and growth of seeds, gemmæ of Hepaticæ, and pollen grains are retarded and may be completely inhibited. Under the influence of the rays chloroplasts change their position in the cell, as under too intense illumination, and they are eventually destroyed, as is embryonic tissue in stems and roots.

Results similar in kind to the above are obtained by the use of radio-tellurium in a sealed glass tube. The influence here is confined chiefly to the α-rays. Experiments with a rod coated with pollonium, which gives off α-rays exclusively, have thus far given negative results.

Growth is retarded and may be inhibited by growing plants in an atmosphere containing the radium emanation, such as may be drawn from a cylinder lined with Lieber's coating.

Photographs of the experiments and specimens of the various radio-active preparations were exhibited.

The second paper, entitled 'Some Interesting Plants from Colombia,' was by Dr. H. H. Rusby.

In view of the lateness of the hour Dr. Rusby stated that he desired to reserve his paper as planned for some future meeting, when he could take the time to treat it more adequately, and for the present he would show some of the more interesting specimens and briefly comment on the same.

The collections were made by Herbert H. Smith, who spent four years collecting in the United States of Colombia near the town of Santa Marta, which is about fifty miles from the coast in the Sierra Nevada Mountains. Although this territory was collected over quite extensively by Karsten, whose collections are at St. Petersburg and consequently not readily accessible, and by Wm. Purdy, and various orchid collectors, Mr. Smith's efforts disclosed many novelties.

The total collection studied contained about 3,000 numbers, embracing between 2,300 and 2,400 species, of which number about fifteen per cent. are likely to prove new to science.

The specimens exhibited were most interesting, embracing arborescent Violaceæ, handsome twining Senecios, showy Vacciniaceæ, numerous anomalous Compositæ, and many other things undreamt of by collectors in temperate climes.

EDWARD W. BERRY,
Secretary.

DISCUSSION AND CORRESPONDENCE.

EXOGLOSSUM EAST OF THE DELAWARE BASIN.

TO THE EDITOR OF SCIENCE: In the issue of June 30, last, Mr. H. W. Fowler, of Philadelphia, writes on the occurrence of *Exoglos-*

sum maxillingua (Le Sueur), in the Delaware basin. It may be of interest to know that *Exoglossum* also occurs east of the Delaware basin. I caught one in 1899, in Peckman's Brook where the Morris Canal crosses the brook near Little Falls, Passaic Co., N. J. If *Exoglossum* is not indigenous to the Passaic basin it may have reached there from the Delaware River *viâ* Musconetcong River and Lake Hopatcong. This lake is the summit feeder of the Morris Canal. The fish lived for many months in an aquarium. It has the feeding habits of the suckers and remains mostly near the bottom.

Eugene Smith.

Hoboken, N. J.

Special Articles.

Discovery of the Comanche Formation in Southeastern Colorado.[1]

During a visit to the Two Butte in Prowers County, Colo., some time ago, I found that a small local uplift east of the butte reveals the Comanche formation filled with characteristic *Gryphœa corrugata*. The locality is on the main, or South Butte Creek, four miles west-northwest of the old town of Albany, or five miles east-northeast of the Two Butte. To the east and west the low bluffs in the valley consist of Dakota sandstone rising gently towards the Two Butte laccolith and the general anticline extending north and south in the southeastern portion of Prowers County. The Comanche beds are exposed just southwest of Mechling's Ranch in a small local anticline and they extend for some distance along the south side of the creek, in low bluffs capped by Tertiary deposits. The lowermost member appearing is a dark shale, more or less sandy, grading upward into a friable, brown sandstone, in part calcareous. The fossils occur in great abundance in the sandstone and sparingly in the dark shale. Owing to overlap of Tertiary sands and gravels, the precise relation to the Dakota sandstone is not clearly revealed, but it is apparent that the Comanche beds lie a very short distance below the main Dakota ledges appearing to the eastward, although probably separated by some dark, non-fossiliferous, sandy shales which lie at the base of the Dakota cliffs in a gorge extending eastward. Probably the Red beds lie at no great distance below, but they do not appear in the immediate vicinity. A few miles west, about Two Butte, the Red beds, with their capping of Exeter sandstone, and included limestone, are extensively exposed. Down stream a short distance, east of Two Butte, the Exeter sandstone is seen to be overlain by shales and limestone of typical Morrison formation, in turn capped by Dakota sandstone. No traces of Comanche beds were found in this vicinity. It was hoped that the relations of the Morrison and the Comanche formations could be ascertained in this general region, but, owing to the apparent failure of the former to reappear in the uplift near Mechling's Ranch, no evidence was obtained on this point.

In December, 1902, Mr. Willis T. Lee gave the Geological Society of America an account of the extension of the Morrison formation down the Cimarron Valley to Exeter, Oklahoma, and the discovery of a low anticline ten miles farther east, in which the Dakota sandstone is underlain by fossiliferous Comanche beds.

Another item of interest which I observed in the vicinity of Two Butte uplift was the occurrence of oyster shells in considerable numbers in the Dakota sandstone on Butte Creek just below the Downing Ranch, three and a half miles due east of Two Butte and constituting a ten-foot bed a half mile southeast of Pilleau's Ranch on the headwaters of the North Fork of North Butte Creek, five miles north by east of Two Butte.

N. H. Darton.

U. S. Geological Survey.

[1] Published by permission of the director of the U. S. Geological Survey.

Some of the Results of Three Years' Experiments with Crown Gall.[1]

The diseases ordinarily classed as crown gall are found on the following plants: almond, apple, apricot, ash, blackberry, chestnut, cherry, grape, hop, oak, peach, pear, plum,

[1] Summary of a lecture given at the annual meeting of the American Association of Nurserymen at West Baden Springs, Ind., June 15, 1905.

prune, poplar, quince, raspberry, rose, walnut and willow. Of a number of these, little is known of their nature. Those of the apple, pear and quince are similar in nature, and are not yet proven to be contagious. Those of the almond, apricot, blackberry, cherry, peach, plum, prune and possibly chestnut and walnut, are similar in nature and origin, and are often very contagious. Those of the grape and rose appear to be slightly contagious, but can not be classed with either of the preceding groups with our present knowledge. The crown gall or root galls of the hop contain a slime mold, a *Plasmodiophora* resembling *Plasmodiophora brassicæ*. No study has been made at the laboratory of the disease on the other plants mentioned in the list, but these will be taken up at once in connection with the others.

Careful experiments with apple, quince and pear seedlings raised from sterilized seed in sterilized soil, watered with sterilized water, indicate strongly that both the apple and pear crown gall of the ordinary hard type, the one devoid of numerous side roots or 'hairy roots,' is not contagious. These seedlings of apple, pear and quince inoculated with insertions of live apple and pear galls beneath the bark and wood of the roots, and also with minced galls in the soil, remained free from disease in both the control and inoculated portions of two years' experiments. Carefully selected apple seedlings grown in the nursery were inoculated both in the greenhouse and in field plots. In the experiments for two years the average result from such inoculations was ten per cent. of diseased plants in the inoculated portion and fifteen per cent. in the control portions of the plot. All galls were counted, whether located on the plant at the place of inoculation or not. Extensive inoculation of apple root grafts in the field for two years gives an average of 27 per cent. of plants with galls both in inoculated and control portions of the plots. About 10,000 apple trees were used in the above sets of experiments.

embodying a portion of the results of an investigation at the Mississippi Valley Laboratory of the U. S. Department of Agriculture (Dr. Hermann von Schrenk in charge).

The ordinary apple crown gall is of two types, the one a more or less woody gall with no roots growing from it, the other with few to numerous roots present. The former type has been used in the experiments just described. There is in addition a diseased form called 'hairy root' in which numerous side roots branch from a stunted root. Galls may or may not occur in connection with this form, which is now considered a distinct disease, and which is at present under investigation.

The crown galls of the peach, plum, cherry, raspberry, almond and apricot have been proved by careful inoculation experiments with seedlings of each grown from sterilized seed in sterilized soil, watered with sterilized water, to be one and the same disease on each of these plants. Peach and raspberry are most susceptible to wound inoculation, but also become diseased in infected soil without artificial wounds being made. This disease has not been contagious on the apple, pear and quince.

The results from an experiment with 300 two-year-old apple trees, 175 of which were diseased and 125 healthy, all trees being selected with care to have a uniformity of size and root system, indicate that the disease has no immediate effect on the duration of the life of the tree where other diseases do not enter. At the end of one year, five of the healthy trees and seven of the diseased had died, and no difference in the growth and appearance of the two classes of trees could be noted. This experiment will be continued for a number of years. Field observations bear out the conclusion that the disease does not often kill young trees, as has been asserted.

There is present on the roots of some apple seedlings, and more rarely on grafted apple trees a gall growth of a softer nature, more like that on the stone fruits, and which may prove to be of a slightly contagious nature. A study is being made of this type and the 'hairy root' disease, which also occurs on the cherry and peach. Grafted apple trees often have as high as 50 per cent. of diseased trees, budded trees, on the other hand, usually have

only a small per cent. affected. Most of the galls on grafted trees occur at the lower end of the scion at the point of union of the root and scion. Much of the work of the previous two years is being repeated this year, field plots in eight different localities having been planted with 120,000 apple seedlings and root-grafts.

George Grant Hedgcock.

MT. TSUKUBA METEOROLOGICAL OBSERVATORY, FOUNDED BY H. I. H. PRINCE YAMASHINA.

Since the time of Pascal it appears to have been recognized that the exploration of the upper atmosphere is one of the most important for the advancement of cosmical physics. So long as this ocean remains unexplored, modern meteorology will remain at a standstill, since the thermal, electrical, and dynamic conditions of this ocean are in great measure responsible for the meteorological conditions at the earth's surface. Many balloon ascents and kite experiments have, therefore, been undertaken from time to time, and many mountain observatories have been established in Europe and elsewhere by men who determined to capture the secrets of the upper air.

In Japan, too, the importance of the exploration of the upper atmosphere has been recognized ever since the organization of the meteorological service in 1875. Many meteorological expeditions to high mountains have been undertaken by the officials of the Central Meteorological Observatory at Tokio, and by those of the provincial stations, to investigate the phenomena and processes in the high strata of the atmospheric ocean. For instance, to Mt. Fuji (3,720 meters above sea level) during every summer since 1889; to Mt. Gosaishodaké (1,200 meters) in 1888; to Mt. Ontaké (3,060 meters) in 1891; to Mt. Ishizuchi (1,980 meters) in 1894; and to several other mountains whose heights range from 3,000 meters to 740 meters. But all these expeditions have been undertaken only in the warmest season of the year, on account of the impracticability of long residence on the summits in winter time. For the establishment of a first permanent mountain observatory, we owe thanks to the illustrious Prince Yamashina. His Imperial Highness has selected for his observatory Mt. Tsukuba, a remarkable mountain, which stands lonely on a most extensive plain, isolated from all mountain ranges, and which is, moreover, on that part of the Island Empire where cyclones of a very intense character frequently pass by.

Mt. Tsukuba is situated on the eastern coast of Japan, forty miles north-northeast of Tokio. The shape of the mountain is quite conical and its summit splits into two peaks, the western and the eastern. These peaks are one half mile distant from each other, the west peak being the higher of the two. Though only 2,925 feet, or 870 meters, in height, Mount Tsukuba has a commanding view over Musashino, the most extensive plain in Japan. Still grander is the view southwestward from the top of the mountain. The city of Tokio and innumerable towns are dimly visible on the plain. Many miles beyond, the snow-capped summit of Mt. Fuji, the volcanic peak of the Asama, and the holy mountains of Nikko form a magnificent panorama. Toward the south there is nothing visible but the vast Pacific Ocean fading away into infinite space. The whole mountain is covered with pines and cryptomerias, and its summits are dotted with legendary curiosities and shrines, the largest of which latter are sacred to Izanagi and Izanami, the first god and goddess of the mythological Japan. The legend is that Izanagi and Izanami constructed this mountain as a bulwark against the waves of the Pacific, which they had forced to retire to the other side of Kashima, formerly an island in the sea. This tradition is in accordance with the fact, recently verified by Japanese geologists, that the east coast of Japan has been gradually rising during many centuries past. In the midst of this region of poetry and legend our prince-scientist has established his meteorological observatory on the top of the west peak, which, with its two base stations, has been in active operation since the first of January, 1902. The geographical coordinates of the observatory are:

$\phi = 36° 13'$ N.
$\lambda = 140° 06'$ E.
$H = 870$ meters a. s. l.

The main building is constructed of massive wood on a solid stone foundation and is covered with zinc plates for protection from moisture. The building contains an instrument room, a workshop, an office and rooms for the staff. The observatory is perfectly equipped with meteorological and seismological apparatus of the latest designs. A few yards north of the building there stands a high tower of iron construction (11.6 meters in height), on the top of which an anemometer rests. Prince Yamashina's self-registering anemoscope, Robinson's anemometer, Jordan's sunshine recorder and Richards's anemograph for the registration of the vertical component of the wind, are all placed on the upper platform of this tower. To the west of the main building stands a thermometer shelter, in which thermometers, psychrometers with Assmann's ventilation arrangement, a hair-hygrograph and a thermograph of largest model are kept. Under this shelter, ten earth-thermometers are buried at different depths below the earth's surface, with perfect arrangements for the measurement of the surface and underground temperatures.

On the roof of the main building there may be found a lightning rod, wind vane, self-registering and ordinary rain gauges and an anemometer. The instrument room is elegantly equipped with the best meteorological instruments, the more noteworthy of which are Richards's barograph of largest model, self-registering pluviometers, anemometers, mountain barometers, etc. These are placed on stone piers.

It is worthy of special mention that macro- and micro-seismographs have been installed on a granite pier which rests on a gigantic rock. One of the seismographs is the famous horizontal pendulum seismograph devised by Professor F. Omori, the illustrious seismologist of Japan. All seismographs, including Gray's conical pendulum instrument and Ewing's horizontal pendulum seismograph, record ordinary or strong earthquake motion, but fail to give reliable records of the very small or slow motions accompanying earthquakes and of pulsatory oscillations. Professor Omori has adopted the conical pendulum and has constructed a seismograph which can be made to give records not only of earthquakes, both ordinary and strong, but of very small or slow movements of the earth, accompanying earthquakes or due to distant earthquakes, of pulsatory oscillations and of slow changes of level.

In the International Seismological Congress, which was held at Strassburg in 1901, Professor Omori pointed out the importance of seismological observations on mountains and high elevations. No country had as yet undertaken seismological observations on mountains as high as Mt. Tsukuba, until Prince Yamashina equipped his observatory perfectly with seismological instruments. Since this establishment, many seismic phenomena have been observed, the most extraordinary of which were the horizontal movements of the earth's crust in January, 1902. The horizontal motion of microseismic nature which was east-westwise began at 11:09 P.M. on the fourth of January and lasted until the sixth. Again a movement of the same nature began on the twelfth of that month and lasted for a few days. The seismogram given by Omori's instrument shows that these movements began almost at the same hour on each day and ceased in the same way, and that the curves of oscillations are of the same nature. Horizontal movements of such intense character had never been observed before; the most remarkable fact is that nothing was recorded on the lower level.

In connection with this observatory, two base stations were established by Prince Yamashina. The first one is situated at the foot of the mountain, at the height of 36 meters above sea level. The second was built on the east side of the mountain at the height of 240 meters. All the important meteorological elements are here observed three times daily, besides being self-registered.

The personnel of the observatory consists of several observers and computers. As the positions of the director and meteorologists are

not yet filled, the observatory is under the temporary charge of Dr. T. Okada, an assistant meteorologist in the Central Meteorological Observatory of Tokio, and who is one of the ablest and most active among the young scientists of Japan.

The establishment of the Mt. Tsukuba Meteorological Observatory by Prince Yamashina is certainly the initiative of a permanent meteorological survey of the upper atmosphere in Japan, and there can be no doubt but that this generosity of His Imperial Highness will prove eventually to be a great contribution to cosmical physics. As above mentioned, the topography of the mountain is peculiarly favorable to the study of meteorology and its allied sciences. Moreover, the mountain lies on the route taken by many cyclones, so that the observations at this observatory will contribute as much to the study of atmospheric motions, as they will to the physics of the atmosphere in general.

S. Tetsu Tamura.

Washington, D. C.

CURRENT NOTES ON METEOROLOGY.

MONTHLY WEATHER REVIEW.

There is much of general scientific interest in recent numbers of the 1905 volume of the *Monthly Weather Review* of the United States Weather Bureau. This publication is becoming more and more indispensable to students of meteorology, and is now well recognized as one of the important meteorological journals of the world. One feature of the *Review* is the monthly list of 'Recent Papers Bearing on Meteorology.' This bibliography of current literature would be far more useful if some system of listing titles were adopted other than that now used. At present the articles are listed under the names of the different journals and other publications. These names are not given alphabetically, and while the number of the volume is given, the year is not included. Where so much space is allotted to these bibliographical lists, it is much to be regretted that some more systematic, and hence more useful, scheme of listing is not adopted. With the first number of the 1905 volume a new list of recent publications is started, under the heading, 'Recent Additions to the Weather Bureau Library.' These, it is to be noted, are arranged alphabetically, but the year is not in all cases given.

The following papers have appeared in recent numbers of the *Review:*

No. 1, 1905, 'Escape of Gases from the Atmosphere,' by Dr. G. Johnstone Stoney, F.R.S., reprinted from the London, Edinburgh and Dublin *Philosophical Magazine and Journal of Science,* Vol. 7, June, 1904, 6th series, p. 620. A subject of theoretical interest in meteorology, but of great uncertainty.

'Meteorological Charts of the Indian Ocean,' by C. F. Talman. For some years the Meteorological Service of India issued daily synoptic weather maps of the Indian monsoon area, for the region between 36° N. Lat. and 12° S. Lat. It has now been decided to extend the field of observation over the greater part of the South Indian Ocean, and also to include broad areas of the surrounding continents and islands. This new enterprise is an important step towards 'world meteorology,' with successful long-range forecasting as the ultimate end in view.

'Apparatus for Instruction in Physics and Meteorology,' by Professor C. Abbe. A few well-considered suggestions as to the inadvisability of using expensive and complicated instruments in schools. Those who have seen teachers and scholars trying to understand fully the workings of some of the more complex instruments will cordially agree with Professor Abbe.

No. 2, 1905, 'A Relation between Autumnal Rainfall and the Yield of Wheat of the Following Year,' by W. N. Shaw, secretary of the Meteorological Council. Read before the Royal Society, February 2, 1905. The author finds that the dryness of the autumn is the dominant element in the determination of the yield of wheat of the following year in Great Britain. This is one of the few investigations which lead to a fairly definite and direct relation between crop yield and the variation of some meteorological element.

'High Water in the Great Lakes,' by Professor A. J. Henry. The outlook for the present season of navigation is not favorable to a

continuation of the high water of 1904, although this will probably rank as a season of relatively high water, especially on the upper lakes.

'The Diurnal Periods of the Temperature,' by Professor F. H. Bigelow. One of Professor Bigelow's studies on the diurnal periods in the lower strata of the atmosphere, in which he undertakes a critical discussion of the results obtained from balloon and kite ascensions during the past ten years.

'Mathematical Theory of Ice Formation,' by S. T. Tamura. A highly mathematical paper, summarizing what has been done along this line by mathematical physicists and also suggesting new lines of investigation.

'The Fourth International Conference on Aerial Research,' being an account of the meeting in St. Petersburg in September, 1904.

'The *Meteorologia Generale* of Luigi de Marchi.' A review of de Marchi's recent book, which is really a short treatise on physical meteorology.

NOTES.

IT is interesting to note the receipt of the First Report of the Transvaal Meteorological Department, containing the observations for July, 1903, to June, 1904, inclusive.

HARROW, as reported in the London *Standard* of June 8, 'has been alone among the public schools in the non-registration and in the non-publication of an annual series of weather observations.' Recently a full equipment of meteorological apparatus, as well as a meteorological library, have been presented to the school. This should serve as an incentive to persons in the United States, where, in spite of much that is encouraging in the situation as regard meteorological instruction, there is still a great deal that needs attention.

DR. W. J. S. LOCKYER, who has been paying special attention to the relation between solar changes and weather, has recently said (*Nature*, June 8, 1905), in a summary of recent work along these lines: 'There is * * * no reason why we should take a pessimistic view of the attempts made to solve this fascinating riddle of the relationship between changes of solar activity and the vagaries of the weather.'

In the *Meteorologische Zeitschrift*, No. 4, 1905, O. V. Johansson has a paper entitled 'Ueber den Zusammenhang der meteorologischen Erscheinungen mit Sonnenfleckenperioden.'

Ciel et Terre, Vol. 26, 1905, No. 5, publishes a useful tabular summary of the temperatures (mean monthly) observed during recent Antarctic expeditions. This is the first summary of the kind which we have seen. It is accompanied by some notes on meteorological phenomena observed during these different expeditions.

The preparation of an index of weather maps illustrating typical conditions, as an aid in forecasting, is discussed by Captain W. Kesslitz in the *Meteorologische Zeitschrift*, 1905, No. 4.

THE actinometrical observations made by A. Hansky, on Mont Blanc, during 1900, are p. 422. Crova apparatus was employed. The value of 3.29 for the solar constant is given as probably the most accurate, on the basis of these observations.

R. DEC. WARD.

SCIENTIFIC NOTES AND NEWS.

DR. NICHOLAS MURRAY BUTLER, president of Columbia University, has received the doctorate of letters from Oxford University and the doctorate of laws from the University of Manchester. While in London Dr. Butler has been entertained by the chairman of the London County Council, the principal of London University, and at a banquet presided over by the minister of education.

THE University of Edinburgh has conferred its honorary doctorate of laws on Professor W. S. Halsted, surgeon in chief of the Johns Hopkins University of Baltimore; Professor I. H. Cameron, of Toronto; Professor Francis J. Shepherd, of Montreal, and Professor W. W. Keen, the Philadelphia surgeon, all of whom are attending the celebration of the quarter-centenary of the Royal College of Surgeons.

LORD KELVIN and Sir William Christie have been elected honorary members of the Optical Society.

The Society of Chemical Industry held its annual dinner in London on July 12, Dr. William H. Nichols, of New York City, presiding. Speeches were made by Lord Alverstone, Professor C. F. Chandler, of Columbia University, Sir William Huggins and others. Among the Americans present were Dr. H. W. Wiley, of the U. S. Department of Agriculture, and Professor Charles Baskerville, of the College of the City of New York.

Mr. John Hyde, chief of the Bureau of Statistics of the Department of Agriculture, has resigned. In his letter accepting the resignation, Secretary Wilson said: "I am familiar with your devotion to your work and with the untiring efforts you have made to render the bureau of the highest service to growers, manufacturers and consumers of farm products in our country, and I regret that failing health should compel you to bring your work to an end."

The Baly gold medal of the London College of Physicians, which is awarded every second year for the most distinguished work in physiology, has been conferred on Professor Pavlov, of St. Petersburg.

The Mary Kingsley medal of the Liverpool School of Tropical Medicine has been awarded to Dr. Laveran, of the Pasteur Institute, Sir Patrick Manson, F.R.S., and Sir D. Bruce, F.R.S.

London University has awarded the Rogers prize of £100 to Mr. B. J. Collingwood, M.B., B.C., for his essay on 'Anesthetics, their Physiological and Clinical Action.' The essay submitted by Dr. A. G. Levy, M.D., was highly commended, and the senate awarded him an honorarium of £50.

Dr. Fred Neufeld, assistant in the Berlin Institute for Contagious Diseases, has been given the title of professor.

Dr. Barton W. Evermann, chief of the Division of Scientific Inquiry and ichthyologist of the U. S. Bureau of Fisheries, has been appointed curator of the Division of Fisheries, U. S. National Museum. He still retains his connection with the Bureau of Fisheries.

The commencement address of the Case School of Applied Science, at Cleveland, was delivered by Dr. George T. Moore, of the Department of Agriculture, upon 'The Creation and Development of Plant Industries by the Government.'

It is proposed to collect a fund in memory of the late Professor G. B. Howes, F.R.S., professor of zoology in the Royal College of Science, London, the fund to be used to purchase an annuity for his widow and daughter. Americans who wish to join in this memorial may send subscriptions to Mr. Frank Crist, 17 Throgmorton Avenue, London, E. C.

A correspondent writes to *The Nation*: "I have been watching for some notice in the *Nation* of the death of Dr. Washington Matthews. Among American ethnologists he ranked not lower than second. Without the horizon of genius to put him on a par with Bandelier, he had a distinction all his own. In all American history, no other one man has known so intimately much about any aboriginal tribe as Matthews did. His studies of the Navajo are the most exhaustive thing of their sort in all our anthropology. He was an extremely modest man, without the gift of popularity, either in his writings or in his intercourse. Of an extremely sweet and unselfish disposition, and much beloved by those who knew him, there was not a bit in him of self-seeking or pushing to the front. He accepted, with a whimsical patience, but with his eyes open, his latter-day function as the original source from which a hundred 'popularizers' built up notoriety for themselves, without credit to him. He was a real martyr—using that abused word without abuse—both to his duty as an army surgeon and his duty as a scientist; and the great mass of accurate and intimate research that he has left to us will always remain among the chiefs of the corner in our scientific edifice."

Sir William Muir, principal of the University of Edinburgh from 1885 to 1903, died on July 11, at the age of eighty-six years.

Dr. Theodor Cleve, professor of chemistry at Upsala, died on June 18.

DR. JOHANN HERMENEK, professor of hydromechanics at the Vienna School of Technology, died on June 15, at the age of forty-one years.

THE U. S. cruiser *Minneapolis*, conveying Rear-Admiral Chester, superintendent of the Naval Observatory, and the other members of the American expedition which will observe the eclipse of the sun at Bona, Algeria, and Valencia, Spain, on August 29, which sailed from New York on July 3, arrived at Gibraltar on July 15. The auxiliary cruiser *Dixie* and the supply steamer *Cæsar*, having on board the instruments and materials for the observation stations, have also reached Gibraltar.

THE French Association for the Advancement of Science will meet during next week at Cherbourg.

THE Royal Institute of Public Health announces that a congress on that subject will be held in London from July 19 to 23, and that papers will be read on discussion held under the various sections of (A) preventive medicine, (B) municipal administration of the Education Acts, (C) child study and school hygiene, (D) engineering and building construction, (E) bacteriology and chemistry, (F) veterinary hygiene, (G) tropical hygiene, and (H) naval and military hygiene.

THE American Medical Association, at its recent Portland meeting, adopted a resolution drawn up by Dr. Liston H. Montgomery, of Chicago, advocating the creation of a new cabinet position to be known as the Department of Public Health, the secretary of which is to rank with other cabinet officers.

THE French minister of public instruction has proposed a grant of 35,000 francs to enlarge the meteorological observatory on Puy de Dôme.

Nature states that it learns from the Royal Society that as an adjunct to the International Laboratory of Physiology on Monte Rosa a lower laboratory, with a hostel, has been established at Col d'Olen. This lower laboratory is mainly intended for biological research, but it is understood that provision has also been made for the study of terrestrial physics and meteorology. The Royal Society has the permanent nomination to two posts, each of which includes a living room in the hostel, a bench in the laboratory and the use of apparatus; but the expenses of living and of special researches must be borne by the investigators. The laboratory is especially connected with the University of Turin, but is under the immediate direction of a committee.

IN connection with the International Exposition to be held this year at Liège, Belgium, under the patronage of the Belgian government, there will be a second session of the International Congress of Agricultural Education on July 28 and 29.

A REUTER telegram from Paris says: The International Congress on Colonial Agriculture was opened on June 22, Great Britain, Holland, Germany, Italy, Portugal, the United States, Mexico and Brazil being represented. Various papers were read, including one by Mr. Webster, one of the British delegates, on the cultivation of tea in Ceylon. The members of the congress decided to form an international committee for the study of all questions relating to agricultural science and colonial industries. An organizing committee, with headquarters in Paris, under the chairmanship of M. de Lanessan, has been formed. In the afternoon the foreign delegates were received by the municipality at the Hotel de Ville, where a luncheon was given in their honor.

The Journal of the American Medical Association says: At a banquet in aid of the funds of the London School of Tropical Medicine, at which $50,000 was subscribed, Sir Patrick Manson gave a lucid account of the work of the school and sketched a plan for systematic and coordinated research in tropical disease centers. This consists in the establishment of colonial research laboratories in places where they are likely to achieve profitable results. Already three such laboratories have been established—in Ceylon, at Kuala Lumpur, in the federated Malay states, and in Hongkong. Sir Patrick Manson suggested

that one such laboratory should be established for every group of crown colonies, the director to be in organic relation with the London school, but with a free hand to take up any special line of investigation in tropical diseases. The directors of these laboratories should be educated in their special work at the London School of Tropical Medicine; East Africa, Uganda and British Central Africa might form one group, the West Coast of Africa another, the West Indies and British Guiana a third, Fiji and the Pacific islands a fourth. Thus there would be seven laboratories affiliated with the London School of Tropical Medicine. Sir Patrick Manson also emphasized the importance of educating the natives in tropical hygiene. He suggested that tuition in the rudiments of the subject should be included in the curriculum of colonial government schools, so that when the child grows up he may be willing to submit to sanitary measures. Without the cooperation of the natives it is hopeless to try to get any scheme, however good, carried out. A necessary preliminary is the preparation of primers for the instruction of school teachers who in turn would teach children.

The British postmaster-general has issued a notice that reads as follows: The attention of the postmaster-general has been drawn to the fact that pathological specimens are frequently sent by post by members of the medical profession and other persons in packets which have not been registered as required by the post office regulations. The postmaster-general desires to give notice that the transmission of such specimens is sanctioned only on the condition that they are handed in at a post office for transmission by registered letter post, and that they are packed in accordance with the regulations published in the Post Office Guide. These regulations, which are necessary for the protection of the post office servants and of the public, provide that any deleterious liquid or substance sent by post must be enclosed in a receptacle hermetically sealed, which receptacle must itself be placed in a strong wooden, leathern, or metal case, in such a way that it can not shift about, and with a sufficient quantity of some absorbent material (such as sawdust or cottonwool) so packed about the receptacle as absolutely to prevent any possible leakage from the packet in the event of damage to the receptacle. The packet must also be marked 'Fragile with care.' Any person who sends by post a deleterious liquid or substance for medical examination or analysis otherwise than as provided by these regulations is liable to prosecution, even if he be a patient sending something to his medical adviser for his opinion or a medical practitioner sending something to a laboratory or elsewhere.

UNIVERSITY AND EDUCATIONAL NEWS.

The British government will allocate £20,000 a year to the new College of Technology at South Kensington out of the treasury subsidy for the maintenance of the Royal College of Science and the School of Mines.

The University Review gives the following figures in regard to the Carnegie Trust for 1904: The trustees during the year had for distribution as grants to the universities and for the endowment of research £59,201. In addition, the income of the trust included £50,000 to be utilized in the payment of the class fees of students who applied to the trust and satisfied the necessary conditions. For this purpose £46,000 was distributed. The figures show that out of every hundred students 72 at Aberdeen received fees from the trust, 70 at St. Andrews, 50 at Glasgow and 39 at Edinburgh. To the general funds of the Scottish universities over £38,000 was granted, and £5,000 was distributed for the encouragement of research at the universities.

Dr. H. W. Stuart, of Lake Forest University, has been promoted to the chair of philosophy, vacant through the resignation of Professor Walter Smith on account of ill health.

Dr. W. G. Adams, F.R.S., professor of natural philosophy and astronomy at King's College, London, is about to retire after a service of forty-two years.

Professor Stephen M. Dixon, of Dalhousie College, Nova Scotia, has been appointed professor of civil engineering at Birmingham.